Testing the Accuracy of Step-and-Repeat Machines

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Abstract: With the increasing emphasis on internal register of printed work a test method for accuracy of machines is suggested. Four basic tests are described in detail:

A) Testing the Base Mechanism
B) Testing the Loading Mechanism
C) Testing the Pin System
D) Testing Machine to Machine Accuracy

Recommendations for a step-and-repeat room and stripping recommendations are also discussed.

The considerations for evaluating a new or used step-and-repeat machine are voluminous. Test the accuracy of the machine using a GATF Register Test Grid. The GATF Register Test Grid is a new quality control device used to test the register accuracy of a vacuum frame. The test grid is a 24 x 36-in. (600 x 900 mm) film negative containing a precisely ruled pattern of lines and 8 percent (approximately dot measures 0.00275-in.--0.06875 mm) tint patches, imaged on a dimensionally stable 7 mil (0.007-in. or 0.175 mm) polyester base. Misregister as slight as 0.001-in. (0.025 mm) can be detected with this device.

The degree of misregister that is acceptable in your step-and-repeat machine depends upon the press equipment on which the final job will be run. You must also consider the quality required by your customer. For many markets, registration within 1/4 of a dot would be more restrictive than needed. For other markets 1/4 of a dot movement may not be acceptable.

How often the step-and-repeat machine should be tested depends upon its condition as well as the desired accuracy. Many printers perform the full test on a monthly basis; others test their machines quarterly.

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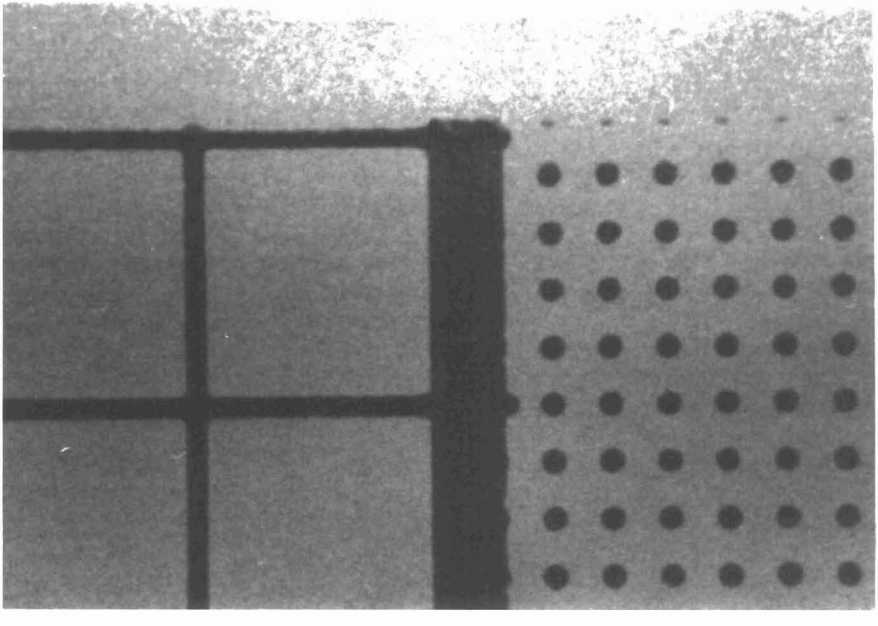
Testing The Base Mechanism

To test for base mechanism movement, cut an original grid if a 0.007-in. (0.175-mm) base is desired or dup one grid on the same thickness of film that is normally used. An 8 x 10-in. (200 x 250-mm) sample should include dots at all four corners. Match the sample to the size of the film that is normally used. Mount it in the same position in which film is mounted when exposing plates. If the normal procedure in a shop is to mount film on a polyester carrier sheet, mount the grid on a carrier sheet. If the film is usually mounted without a carrier, place a mask over it and dupe it to a one-piece film. Expose the grid in eight positions, four times over, without returning the film to the load position. Ideally, dot elongation of the screen tint should not exceed 1/4 of a dot, measured by the 8 percent dot of a 150-line screen.

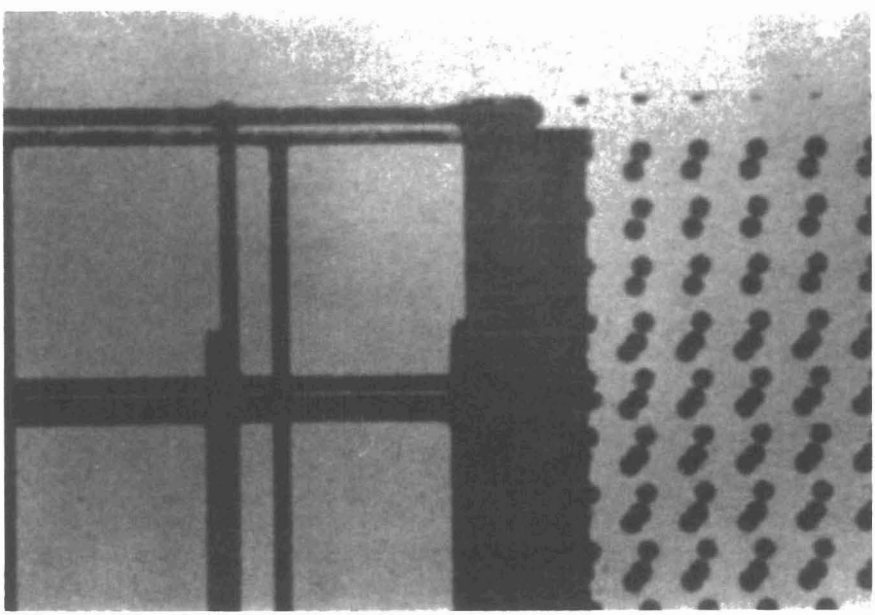


Example #1 - Excellent Register.

Testing The Loading Mechanism

Strip eight pieces of the test grid in the prescribed size, with or without a carrier. Number them 1-8. Expose a plate through grid #1 in the first position, grid #2 in the second position, etc. Expose the plate four times in each position; the movement should not exceed 1/4 of a dot.

Dissimilar materials stripped various ways will load much differently. At this point, the test may be modified to analyze halation. Varying the tape thickness is the preferred method of testing for halation, since it can be consistently repeated. The thickness of the tape or particles of dirt may separate the film and the plate, causing halation.

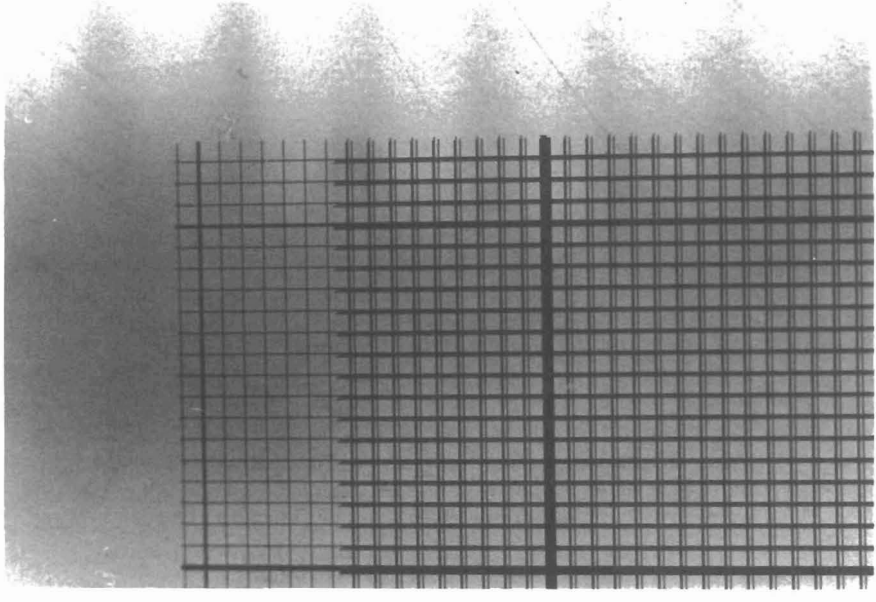


Example #2 - Serious Misregister.

Testing The Pin System

Expose the plate one time through the test grid in each of eight positions. Remove the plate and the grid from the machine. Remount the plate or film on the pins, and repeat this procedure four times. Dot elongation should not exceed 1/4 of a dot.

Testing Machine-to-Machine Accuracy



Example #3 - Machine to Machine Misregister of 1/4-in.

This test requires two or more step-and-repeat machines. The ideal situation would be to remake a plate on the open machine rather than on the one that originally exposed the

plate. Expose the plate one time in eight positions. Remove the plates from the machine, and move it to the next machine, etc. Insure that the plate is exposed four times in each position. Dot movement should not exceed 1/4 of a dot. This test should be conducted on machines of the same model.

Problems uncovered during testing of machines:

1. Static
2. Worn pins
3. Loose pins
4. Punch not matching pins on machine
5. Worn punch
6. Vacuum not being used on bed
7. Bed not properly pinned
8. Insufficient vacuum
9. Machines not matched
10. Loose bearings
11. Wear on various parts
12. Poor stripping
13. Poor cleaning technique
14. Warped bed
15. Machine worn out

Summary

Perform the above tests on negative plates. Please note that the dots should be evaluated under 30-60x magnification. Do not look at the color of the plate, since longer exposures will give darker colors. For test purposes only, cut exposure times by 50 percent on plates. The test should be performed on plates and film. Machines can easily achieve register on a plate but some have difficulity on film. If the machine is used to step one- and two-page spreads on 30 x 40-in. (750 x 1,000 mm) film, 0.007-in. (0.175 mm) thick, it is important to make the test.

Additional Considerations

a. All film should be cleaned before placing it in the machine, and film should never be cleaned while on the pins.

b. The argument of a two-pin system versus a three-pin system for loading film into the machine will be debated for years. Both work quite well in the field plants surveyed.

c. When smoothing the film in the loading mechanism of the machine, smooth it from round hole to square hole using an antistatic wipe.

d. A round pin in the rectangular hole of film in the loading mechanism does not cause misregister if the film is loaded properly.

e. When exposing to 30 x 40-in. (750 x 1,000 mm) film on a step-and-repeat machine, the large film should be mounted on 0.007-in. (0.175 mm) polyester. (0.004-in. polyester is normally not flat enough.)

f. Some step-and-repeat machines require that the input film -- small size film -- be 0.004 in. (0.1 mm) thick if it is mounted on carrier. The film should be 0.007 in. (0.175 mm) thick if not mounted on carrier. This may be a very important point if the film is supplied by a client.

g. If carriers must be used to properly load the machine, then every piece of film loaded on that machine must have a carrier. Remember that, due to scratches, dirt, wear, etc., carriers can only be used once.

h. On some machines, four bleeder strips (usually masking tape) must be used on each piece of film loaded in the machine; this helps achieve good contact and eliminate halation. This is a very time consuming and annoying operation.

i. The carrier film should be antistatic coated on both sides.

j. The halation test is important to check vacuum, especially if multiple layers of film are exposed. Taped windows can cause halation in the step-and-repeat machine and should be avoided.

k. Dirt in the step-and-repeat machine room cannot be tolerated if carriers are to be used. Ideally, in most operations, carriers should not be used. Dirt that collects between the film and the carrier is almost impossible to remove on a production basis.

l. If size permits, equip the step-and-repeat machine so that it can handle two plates on the bed. This allows for a smoother production flow.

Recommendations for a step-and-repeat room:

1. Ground the machine.

2. Maintain positive air pressure.

3. Eliminate carpeting, it generates static.

4. Include antistatic devices near the film loading zone.

5. Control the temperature and relative humidity.

6. Install electrostatic air cleaning.

Stripping Recommendations

1. Expose all marks and color bars on the step-and-repeat machines.

2. Do not use red stripping tape for making windows.

3. Do not use masking paper.

Testing Results

	Best Case	Worst Case
Bed Mechanism	No movement	3 dots out of register
Loading Mechanism	No movement	5 dots out of register
Pin System	No movement	3 dots out of register
Machine to Machine	No movement	1/4-in. out of register

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